open pan the pressure of the atmosphere amounts to about fifteen pounds per square inch, and in order to raise the liquid to the boiling point this pressure must be overcome. If this pressure can be overcome, or at least largely reduced, then the boiling point can be reached at much lower temperatures than 212° Fahr.

The pressure is diminished by the use of air tight pans and of air pumps. Let us suppose that coils of pipe, connected with the escape pipe of the engine, are laid in a large pan, a supply of clarified juice fills the pan, an air-tight cover is put on, and the contained air is partially exhausted by the air pump. The exhaust steam from the escape pipe of the engine is hot enough to cause the juice to boil. Now let us suppose that the steam from this pan be forced through coils of pipe laid in another air-tight pan filled with juice and more thoroughly exhausted than the first one, it is clear to see that evaporation at a still lower temperature will be secured. Such a combination as above described is called a double-effect apparatus.

A multiple effect would be a multiplication of pans so connected and manipulated that the steam of one will boil the next. The advantages in such arrangements are: (1) lower temperature and less danger of scorching the contents; (2) speed in evaporating the water from the sweets; (3) reduction of cost.

Now if syrup be the end aimed at of course the process would end when a proper degree of concentration has been reached. But if it is desired to make sugar also, then additional process must be employed.

III.—Extraction of Sugar.

Under this head we shall give in brief the methods employed with large success at the government experiment stations in 1891.

The diffusion process affords a juice containing both "sugars" and "non-sugars" in acid aqueous solution. As explained, the acid tends to convert cane sugar into grape sugar, and this is prevented by the use of lime.

The effect of the "non-sugars" is to prevent crystallization and separation of the "sugars": for this reason they are called molasses-makers (melassigenes). Their removal is necessary to the formation of a large "sugar" product. Their removal is partially accomplished in the processes of defecation, i. e., liming, heating and skimming. But there still remain "non-sugars," which are soluble in water and must be separated in some other way. This is now very successfully accomplished by the use of alcohol. The clarified juices are concentrated until they contain about 55 per cent solid matter, then mixed with an equal volume of 90 per cent alcohol, and thoroughly stirred by blowing air through the mixture.

The impurities of the syrup separate in flocculent masses, and in the course of twenty-four hours they completely settle to the bottom of the tanks, leaving a supernatant fluid that is clear and of a pleasant odor.

The next step is to draw off the clear fluid and subject it to distillation, whereby the alcohol is separated and recovered for future use. The sediment is subjected to pressure by which an alcoholic syrup is obtained and a hard cake left containing more or less of sugar and alcohol. Here is the chief loss of alcohol, but the loss may probably be more than replaced by fermentation and distillation of these "press cakes." Here, however, we encounter the United States revenue laws, and modifications would have to be made in the laws before sugar factories could proceed. In fact, the alcoholic process would require so much alcohol that it cannot be profitably employed unless the sugar manufacturer could be allowed to buy, or manufacture, and use alcohol, almost or altogether free of duty. What legislation has been had in regard to this subject we are not prepared to say.

"The syrup, freed from alcohol, was passed through the usual sugar house processes of granulation in the vacuum pan and purging in the centrifugals." (Bulle-